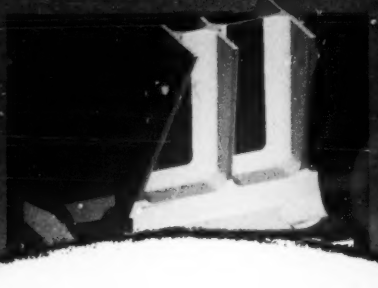
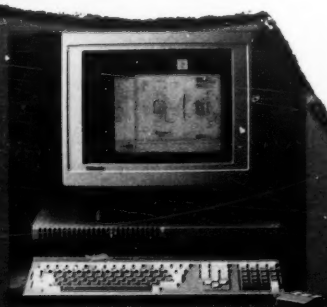
JANUARY 1990

PRODUCTION

THE MAGAZINE OF MANUFACTURING MANAGEMENT



Do I Really Need CIM?



C I S/S R I ACQUISITIONS C-P LONJ
J LONG-ASST MGING EDITOR
4520 EW HIGHWAY
BETHESDA MD 20814

PRODUCTION

JANUARY 1990 THE MAGAZINE OF MANUFACTURING MANAGEMENT VOL. 102 NO. 1

34

51

FEATURES

MANUFACTURING TECHNOLOGIES

34 PRODUCTION State-of-the-Technology Report: The Machining Center

QUALITY

42 We Know It's Not For Comfort
Environmental control in manufacturing is something being preached—and practiced—more and more these days, and the reason why is quality.

DESIGN

51 Designing For Tomorrow
Meet Luigi Colani... an extraordinary automotive designer.

MATERIAL HANDLING

54 Really Planning Material Handling
A serious renovation of a U.S. Army engine plant proves that the way you handle and store materials can vastly improve plant efficiency... and save dollars.

CIM/SOFTWARE

60 "Do I Really Need CIM?"
A report on Autofact '89...

BUSINESS STRATEGIES

65 Which Technologies Are the Best Investments?

ASSEMBLY

68 When Automation Makes Sense
What do you do when your ability to manufacture components outpaces your ability to assemble them?

MATERIALS

72 Cleaning Up the CFC Act
A year after the protocol banning CFC use, here's an update.

BOOK REVIEW

76 George Gilder Essays the Electron
"Listen to the technology and find out what it is telling you..."

Cover photos courtesy of:
Integraph Corp. (Huntsville, AL)
CGTech (El Toro, CA)
Weber Systems (Brookfield, WI)
CADAM Inc. (Burbank, CA)
Dassault Systems U.S.A. (Hasbrouck Heights, NJ)
Fujitsu America (San Jose, CA)
Tektronix (Wilsonville, OR)
IBM (White Plains, NY)

DEPARTMENTS

4 Staff
9 Perspective
A Wish for the Nineties!
10 Update
28 Worth Mentioning
32 Management Side
78 Production Buyers' Guide
90 Literature
93 Classified
94 Calendar
95 Advertisers' Index
95 District Offices
96 Back of the Book
World Challenge Match—The Results

STAFF

EDITORIAL OFFICES

DETROIT

1100 North Woodward Avenue, Suite 120
Birmingham, MI 48009
313-647-8400
FAX 313-645-0749

Robert F. Huber
Editor-In-Chief

Gary S. Vasilash
Editor

CINCINNATI

6600 Clough Pike
Cincinnati, OH 45244-4090
513-231-8020
FAX 513-231-2818
TELEX 214132

Brenda J. Fahringer
Managing Editor

Robin P. Bergstrom
Senior Features Editor

Jann S. Dunn
Assistant Editor

William A. Johnston, CBC
Art Director

Aimee M. Reilly
Assistant Art Director

Susan M. Payne
Artist

EUROPE

Peter Mullins
5 Wilton Close
Street, Somerset BA16 0SZ England
Telephone: 0458-48282

ABP Association of Business Publishers

VBPA

BUSINESS OFFICE

6600 Clough Pike
Cincinnati, OH 45244-4090
513-231-8020
FAX 513-231-2818
TELEX 214132

Steven R. Kline, CBC
Publisher/Vice President

Daniel C. Luciano, CBC
Associate Publisher/Sales Manager

Donald E. Kline
Advertising Manager

Joyce M. Trestel
Advertising Production Manager

Charles Norman
Circulation Director

Philip A. Louis
Director of Data Processing

George E. Hay
Chairman

Richard G. Kline, CBC
President

Jo Ann C. Dooley
Vice President/Finance

Maralah S. Rose-Asch, CBC
Marketing Services Manager

EDITORIAL ADVISORY BOARD

Richard E. Dauch
Executive Vice President/Manufacturing
Chrysler Motors

Thomas Gunn
Vice President, Procurement and Distribution,
Product and Technology Operations,
Unisys Corporation

James L. Koontz
President & Chief Executive Officer
Kingsbury Machine Tool Corp.

Berthold Leibinger
President & Partner
Trumpf GmbH & Co.

J. Tracy O'Rourke
Executive Vice President &
Chief Operating Officer
Rockwell International Corp.

Robert P. Collins
President & Chief Executive Officer
GE Fanuc Automation
North America, Inc.

George R. Ryder
Managing Director
PNA Services, Inc.
A Company of the Pininfarina Group

David C. Scott
Manager, Marketing
Deere Tech Services, Deere & Company

PRODUCTION (ISSN 0032-9819), founded in 1934, is published monthly by Gardner Publications, Inc., 6600 Clough Pike, Cincinnati, OH 45244-4090, telephone 513-231-8020, TELEX 214132, FAX 513-231-2818, and is sent on a complimentary basis to selected engineering and management personnel in production metalworking plants, and selected supplier industries. Complimentary subscription requests should be addressed to PRODUCTION Magazine, 6600 Clough Pike, Cincinnati, OH 45244-4090, and the following information must be supplied: Your name, title, company name and address (including zip code), product(s) produced and approximate number of employees in your plant. Requests must be received on company letterhead or on the business reply card provided in the magazine. All other subscriptions are $36.00 per year in North America, $72.00 elsewhere; airmail to foreign countries $144.00 per year. Printed in U.S.A.

Copyright © 1990 by Gardner Publications, Inc.

Second class postage paid at Cincinnati, Ohio. POSTMASTER: Send address changes to PRODUCTION Magazine, 6600 Clough Pike, Cincinnati, OH 45244-4090. If undeliverable, send Form 3579. PERMISSIONS: Libraries and other organizations registered with the Copyright Clearance Center (CCC, 21 Congress St., Salem, MA 02148-9998) may photocopy any article herein for the flat fee of $2.00 per copy of the article. Copying done for other than personal or internal reference use without the express permission of Gardner Publications, Inc. is prohibited. Address requests for special permission or bulk orders to the magazine. ISSN 0032-9819 $2.00.

The information presented in this edition of PRODUCTION Magazine is believed to be accurate. In applying recommendations, however, you should exercise care and normal precautions to prevent personal injury and damage to facilities or products. In no case can the authors or the publisher accept responsibility for personal injury or damages which may occur in working with methods and/or materials described herein, nor can the publisher assume responsibility for the validity of claims or performances of items appearing in editorial presentations or advertisements in this publication. Names, addresses, and/or telephone numbers are given to enable interested parties to conduct further inquiry into specific products or services.

Cleaning Up

International pressures—as well as those stemming from our own government and private agencies—concerning the environment are forcing makers and users of CFCs to rethink their use and invent their replacement. A year after the protocol banning CFC use, here's an update.

By Robin P. Bergstrom
Senior Features Editor

CHLOROFLUOROCARBONS (CFCs) ARE burning holes in the ozone layer. It's true.

But, you say, CFCs—aren't those the things that were in those fast-food containers and aerosol cans, things that we did away with several years ago along about the time that some environmentalists or scientists looked up and said, "Something's burning holes in the ozone layer."

Yes, and at the time a lot of people looked skyward, didn't see any holes, and didn't believe it.

At the time a lot of people didn't know what ozone was, let alone chlorofluorocarbons.

And now they're back—actually never went away.

A little background. There's little doubt that CFCs have been of significant benefit to industry and consumers—the price paid by the environment notwithstanding—since their development and introduction in the 1930s. They virtually touch much of everyday life—as coolants in air conditioners and refrigerators, as blowing agents in foam insulation, as solvents for cleaning electronics and metals, and as sterilizers for medical devices. Taken together the varied uses of CFCs represent a $28 billion industry, and the fact is that many things we take for granted today—from a safe and varied food supply to efficient global communications to energy efficient homes and cars—would quite simply be impossible were it not for CFCs.

However, while the upside of CFCs seemed pretty well understood, by the mid-1970s two professors from the University of California at Irvine put forward the theory that CFCs might just cause long-term harm to the stratospheric ozone layer.

The theory was this: that CFCs are highly stable compounds which remain intact when they are released into the air, breaking apart only when they reach the stratosphere. There they release chlorine, which destroys ozone molecules that serve as the earth's natural barrier to harmful ultraviolet radiation. Thus the holes, thus the problem.

And a decade and a half later, the theory has been pretty much proven to be the reality.

What's going on now is that under an international agreement, called the United Nations Environment Program (UNEP) protocol, which was signed in Montreal in 1987, most of the nations that manufacture CFCs are required to reduce their production to 50 percent of 1986 levels. This must be done by July 1998. The protocol went into effect a year ago, and since that time, several new aspects have surfaced which may lead to a complete phaseout of CFCs by as early as 1995.

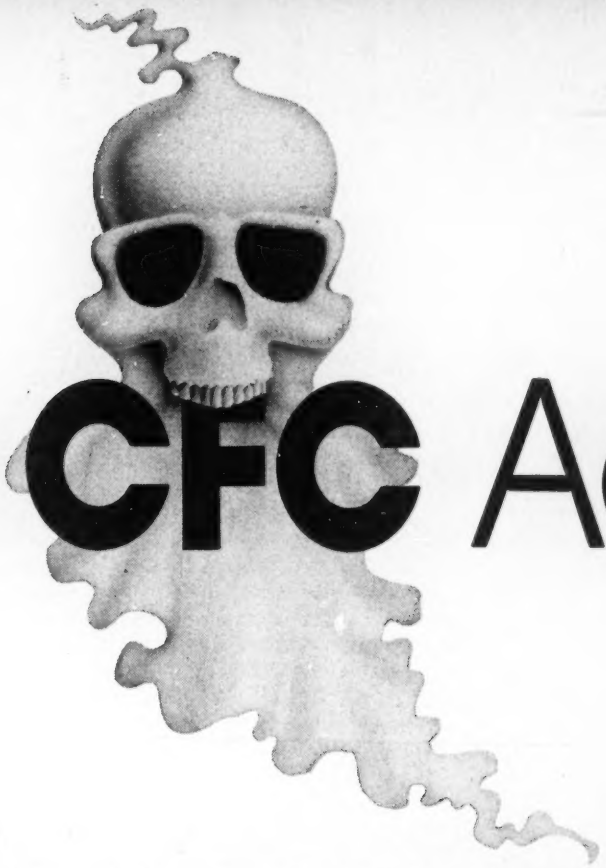
What happened when: 1974: Sherwood Rowland and Mario Molina of University of California, Irvine, put forward the theory that CFCs might be doing serious harm to the stratospheric ozone layer.

Late 1970s: U.S., Canada, and Scandinavia ban use of CFCs as aerosol propellants. Intensive research begins on CFCs and ozone depletion.

March 1985: UN Environmental Programme's (UNEP) Vienna Convention for the Protection of the Ozone Layer produces a treaty calling for international cooperation to further research and, if necessary, to regulate CFC production.

May 1985: British Antarctic Survey Team announces the discovery of a seasonal thinning of the ozone layer over the South Pole.

September 1987: Scientific expedition confirms that CFCs contributed to the Antarctic ozone depletion.



the CFC Act

September 1987: UNEP adopts the "Montreal Protocol on Substances that Deplete the Ozone Layer," requiring signatory nations to reduce CFC production in three stages. It is significant to note here that China did not sign the Protocol—significant in that China plans to build eight CFC plants during the next 10 years to meet its national goal of providing refrigerators for all its citizens. If viable substitutes for CFCs are not available, the Chinese will probably opt to use CFCs no matter what the environmental consequences.

March 1988: Report from the "Ozone Trends Panel" says that ozone depletion is more severe than previously thought and occurs over more heavily populated portions of the globe. Many countries, including the U.S. and the European Economic Community, call for an outright ban on CFCs by the end of the century.

August 1988: U.S. EPA adopts the provisions of the Montreal Protocol as a domestic regulation.

April 1989: A first meeting of the Montreal Protocol Parties, 80 nations agree to tighten timetable established by the Montreal Protocol. They propose that all substances covered by the Protocol be phased out by the year 2000. This non-binding agreement is known as the Helsinki Declaration.

April 1990: The Montreal Protocol Parties will meet to vote on any proposed changes to the Protocol.

Who's doing what? Du Pont Co. (Wilmington, DE) recently announced the development of a product for cleaning metal that performs better than CFC 113—and is safer. An azeotrope-like blend of hydrochlorofluorocarbons (HCFC) 123 and 141b, the product removes grease and water soluble oil residues from common metals and is more compatible with aluminum parts.

"The improved performance of this blend, combined with the fact that it has 94 percent less ozone depletion potential, will provide customers with an excellent choice as we continue to develop a family of alternative cleaning agents," said Ling-Yee Gibney, cleaning agents market manager, "Freon" Products Div. "We have tried to capture and improve on all the performance benefits of our CFC products, while minimizing environmental and compatibility concerns."

Fluorocarbon: End Use Markets 1986

Markets	Usage (Millions Of Lbs)	% Of Total
Refrigeration & air conditioning	414	39
Foam blowing agents	180	17
Solvents	148	14
Fluoropolymers	148	14
Others	170	16
Total	1,060	100%

Source: B.I. DuPont de Nemours

The HCFC-123/141b blend is available in limited quantities for customer evaluation. Commercial quantities of the product could become available in the early 1990s pending favorable toxicology, process development, and market and regulatory acceptance. The blend is the latest development in Du Pont's effort to introduce environmentally acceptable alternatives to fully halogenated CFCs.

Last year the company introduced "Freon" SMT and "Freon" MCA, two interim cleaning agents with 25 and 37 percent less ozone depletion potential than CFC-113, respectively. In March of 1989 Du Pont announced two long-term cleaning agent candidates to replace CFC-113. The first, a blend of HCFCs 123, 141b and methanol, has 90 percent less ozone depletion potential than CFC-113 and the second, a hydrocarbon-based product, has no ozone depletion potential.

Dow Chemical Co. (Midland, MI) recently announced the commercialization of a reduced CFC insulation system with Trailmobile, Inc., a leading manufacturer of refrigerated van trailers.

This technological development is part of Dow's effort to assist customers in complying with EPA rules restricting the use of fully halogenated CFCs. The EPA rules require that 1989 production and consumption of CFC-11, -12, -113, -114, and -115 be reduced to 1986 levels with additional cutbacks to be instituted in 1993 and 1998.

Trailmobile uses a two-part polyurethane rigid foam system containing VORANOL® plyether polyol and PAPI® polymeric MDI in its refrigerated vans and insulated dry vans. CFC-11 is used as a blowing agent to expand the liquid polyurethane into a solid foam material. CFC reduction was accomplished by co-blowing with CO_2 and modification of the polyol component of the Dow system.

Further, Dow will soon begin making STYROFOAM® brand insulation next year using non-fully halogenated CFCs currently used in the manufacturing process. According to Dow, this will be a global program, with the timing of each country depending on the available supply of these alternative CFC materials and any other local testing and approval as required. In the U.S., this work began last year.

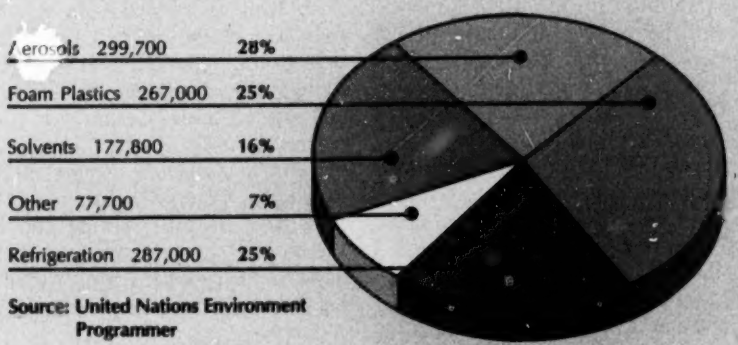
Allied-Signal (Morris Township, NJ) recently announced plans to build the world's first commercial plant to manufacture HCFC 141b, a key substitute for CFCs.

HCFC 141b will substitute for CFC 11 as a blowing agent in urethane foams and will replace CFC 113 in a broad range of solvents. The new product reduces by 90 to 95 percent the ozone depletion caused by materials now in use.

Constrution of the $50 million facility will begin next spring with shipments expected in late 1991. The facility will be easily expandable to meet future market demand. The annual U.S. market for CFC 11 used as a blowing agent is about 200 million pounds. The market for CFC 113 as a solvent is about 165 million pounds.

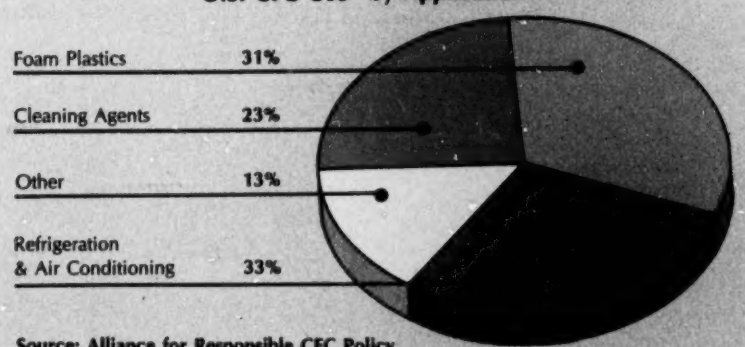
"The solution to ozone depletion is the availability of substitutes for CFCs," said Frederic M. Poses, president of Allied-Signal's Engineered Materials Sector. "Commercial availability of HCFC 141b will be a major step away from CFCs that have been implicated in damaging the earth's ozone layer. Because of the applications in which 141b is used it is expected to replace ozone-depleting CFCs very rapidly. The U.S. needs this product available to meet its obligations under the Montreal Protocol." P

1988 Global CFC Use—by Application (in metric tons)



Source: United Nations Environment Programmer

U.S. CFC Use—by Application



Source: Alliance for Responsible CFC Policy

SET RESET COUNTERS

C4080-1

SET

SET

FEBRUARY 1990

PRODUCTION

THE MAGAZINE OF MANUFACTURING MANAGEMENT

NETWORK 0006 Segment: 02

THE PLC: STILL A CONTENDER

IT 15: COUNTER #1 RESET

IT 14: COUNTER #2 RESET

IT 16: TOGGLING THIS BIT RELOADS THE CONFIG WORD

NMTBA Addresses World Quality

No More Aching Backs?

PRODUCTION Readers To Spend $10.7 Billion

COUNTER 2 RESET

RESET DONE

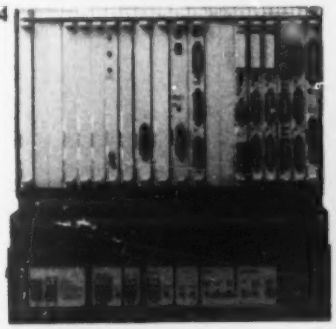
(6.3)

04004

PRODUCTION

FEBRUARY 1990 THE MAGAZINE OF MANUFACTURING MANAGEMENT VOL. 102 NO. 2

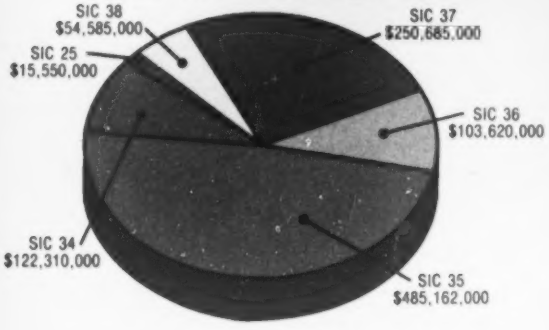
34



62

57

Dollar Volume By 2-Digit SIC



FEATURES

CIM/SOFTWARE

34 The PLC: Still Useful After All These Years
A PRODUCTION State-of-the-Technology Report

QUALITY

43 NMTBA Sets Course For Quality
Now that the NMTBA—Association for Manufacturing Technology has written its book on machine tool quality, will this help the machine tool industry toward better days?

MANUFACTURING TECHNOLOGIES

49 Tackling the Make or Buy Issue

BUSINESS STRATEGIES

51 1990 Capital Spending: Readers' Pockets Get Deeper
Results of PRODUCTION's 1990 Capital Equipment Survey

DESIGN

56 Designing Better Places To Work
Chances are the application of ergonomic principles to virtually any domestic production facility will result in notable positive changes.

ASSEMBLY

60 PCB Assembly: A Total Package

MATERIAL HANDLING

62 It's In The Design

MATERIALS

66 Thin-Film Supers: Flexible, Fast

(Cover "code" courtesy of Modicon, Inc., North Andover, MA)

DEPARTMENTS

4 Staff
9 Perspective
Are We Getting More Competitive?
10 Update
26 Worth Mentioning
30 Management Side
68 Production Buyers' Guide
81 Literature
86 Calendar
87 Advertisers' Index
87 District Offices
88 Back of the Book
Uncommon Wisdom—Almost

STAFF

EDITORIAL OFFICES

DETROIT

1100 North Woodward Avenue, Suite 120
Birmingham, MI 48009
313-647-8400
FAX 313-645-0749

Robert F. Huber
Editor-In-Chief

Gary S. Vasilash
Editor

CINCINNATI

6600 Clough Pike
Cincinnati, OH 45244-4090
513-231-8020
FAX 513-231-2818
TELEX 214132

Brenda J. Fahringer
Managing Editor

Robin P. Bergstrom
Senior Features Editor

Jann S. Dunn
Assistant Editor

William A. Johnston, CBC
Art Director

Aimee M. Reilly
Assistant Art Director

Susan M. Payne
Artist

EUROPE

Peter Mullins
5 Wilton Close
Street, Somerset BA16 0SZ England
Telephone: 0458-48282

ABP Association of Business Publishers

BPA

BUSINESS OFFICE

6600 Clough Pike
Cincinnati, OH 45244-4090
513-231-8020
FAX 513-231-2818
TELEX 214132

Steven R. Kline, CBC
Publisher/Vice President

Daniel C. Luciano, CBC
Associate Publisher/Sales Manager

Donald E. Kline
Advertising Manager

Joyce M. Trestel
Advertising Production Manager

Charles Norman
Circulation Director

Philip A. Louis
Director of Data Processing

George E. Hay
Chairman

Richard G. Kline, CBC
President

Jo Ann C. Dooley
Vice President/Finance

Maralah S. Rose-Asch, CBC
Marketing Services Manager

EDITORIAL ADVISORY BOARD

Richard E. Dauch
Executive Vice President/Manufacturing
Chrysler Motors

Thomas Gunn
Vice President, Procurement and Distribution,
Product and Technology Operations,
Unisys Corporation

James L. Koontz
President & Chief Executive Officer
Kingsbury Machine Tool Corp.

Berthold Leibinger
President & Partner
Trumpf GmbH & Co.

J. Tracy O'Rourke
Executive Vice President &
Chief Operating Officer
Rockwell International Corp.

Robert P. Collins
President & Chief Executive Officer
GE Fanuc Automation
North America, Inc.

George R. Ryder
Managing Director
PNA Services, Inc.
A Company of the Pininfarina Group

David C. Scott
Manager, Marketing
Deere Tech Services, Deere & Company

PRODUCTION (ISSN 0032-9819), founded in 1934, is published monthly by Gardner Publications, Inc., 6600 Clough Pike, Cincinnati, OH 45244-4090, telephone 513-231-8020, TELEX 214132, FAX 513-231-2818, and is sent on a complimentary basis to selected engineering and management personnel in production metalworking plants, and selected supplier industries. Complimentary subscription requests should be addressed to PRODUCTION Magazine, 6600 Clough Pike, Cincinnati, OH 45244-4090, and the following information must be supplied: Your name, title, company name and address (including zip code), product(s) produced and approximate number of employees in your plant. Requests must be received on company letterhead or on the business reply card provided in the magazine. All other subscriptions are $36.00 per year in North America, $72.00 elsewhere; airmail to foreign countries $144.00 per year. Printed in U.S.A.

Copyright © 1990 by Gardner Publications, Inc.

Second class postage paid at Cincinnati, Ohio. POSTMASTER: Send address changes to PRODUCTION Magazine, 6600 Clough Pike, Cincinnati, OH 45244-4090. If undeliverable, send Form 3579.

PERMISSIONS: Libraries and other organizations registered with the Copyright Clearance Center (CCC, 21 Congress St., Salem, MA 02148-9998) may photocopy any article herein for the flat fee of $2.00 per copy of the article. Copying done for other than personal or internal reference use without the express permission of Gardner Publications, Inc. is prohibited. Address requests for special permission or bulk orders to the magazine. ISSN 0032-9819 $2.00.

The information presented in this edition of PRODUCTION Magazine is believed to be accurate. In applying recommendations, however, you should exercise care and normal precautions to prevent personal injury and damage to facilities or products. In no case can the authors or the publisher accept responsibility for personal injury or damages which may occur in working with methods and/or materials described herein, nor can the publisher assume responsibility for the validity of claims or performances of items appearing in editorial presentations or advertisements in this publication. Names, addresses, and/or telephone numbers are given to enable interested parties to conduct further inquiry into specific products or services.

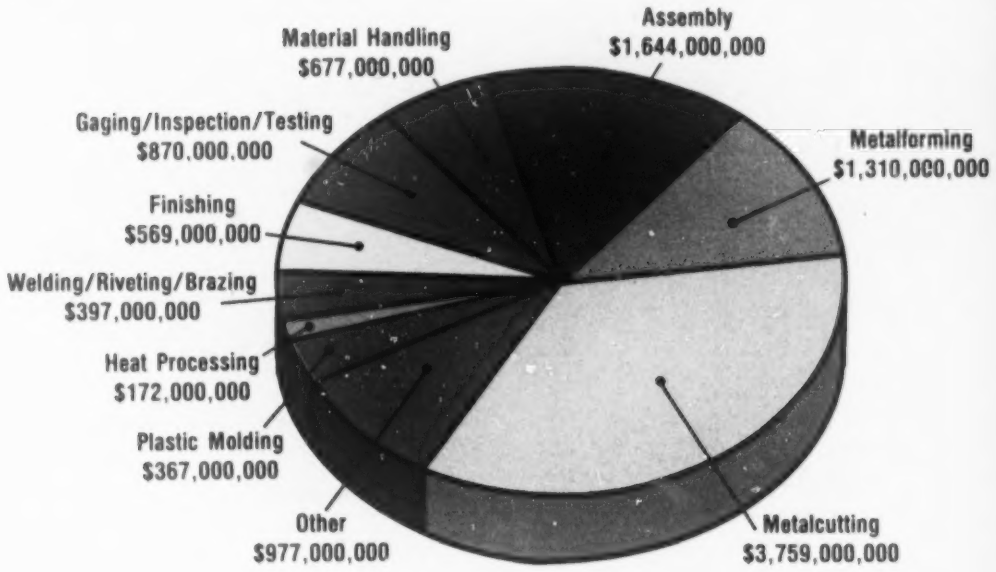
PRODUCTION

1990

Capital Spending:

Reader
Pocket
et Deep

1990 Capital Equipment Projected Expenditures



By Steven R. Kline
Publisher

You are a fairly optimistic group. Or maybe you look at the world through somewhat rose-colored glasses. At any rate, in response to PRODUCTION's 22nd Annual Capital Spending Survey* you painted a relatively bright picture for 1990. Despite some gloomy economic fore-

**This is PRODUCTION's 22nd Annual Capital Spending Survey. It was conducted by Edward D. McCallum, Jr. of McCallum & Associates. For more information, contact McCallum at: McCallum & Associates, 1100 North Woodward Ave., Suite 120, Birmingham, MI 48009. Telephone: 313-646-0630.*

Questionnaires were mailed to a universe of 10,000 plants on the PRODUCTION Magazine circulation list in the discrete parts manufacturing industries: SIC 34, Fabricated Metal Products; SIC 35, Machinery, except Electrical; SIC 36, Electrical Machinery; SIC 37, Transportation Equipment; SIC 38, Instruments; and a few selected companies in the Metal Furniture portion of SIC 25. The universe, by employment, is made up of every plant PRODUCTION Magazine reached employing 250 and over and every Nth plant reached employing less than 250 until a universe of 10,000 plants was assembled. We mail to upper echelon readers—presidents; executives vice presidents; general managers; vice presidents of manufacturing and/or operations; plant, works or factory managers and superintendents; directors of production engineering; and managers of manufacturing—people with lateral interests and access to the dollars and plans needed to complete our questionnaire. We mail one questionnaire per plant, using a computer program to select the highest title reached on an alphabetical search of each selected plant galley. We conducted the survey July 10, 1989, and cut off the response August 9, 1989.

As of the cut off date, 2,825 surveys were returned (28. 25 percent response rate). 2,677 surveys were determined usable.

casts, the mood is rather upbeat. American companies are awakening to the fact that efficient manufacturing is the key to becoming world competitive.

Three times as many plants plan to increase spending as those looking at cut-backs. More than half of all respondents believe 1990 will see higher operating levels. This positive outlook translates into $10.74 billion of spending on productive equipment—an increase of 8.4 percent over 1989's $9.91 billion. One cautionary note: when compared with 1989, fewer (by percentage) respondents indicated they'd be increasing spending (43.7 vs. 47.5 percent), while more said they'd be decreasing (15.3 vs. 13.4 percent). And inflation accounts for 5 percent of that 1990 gain.

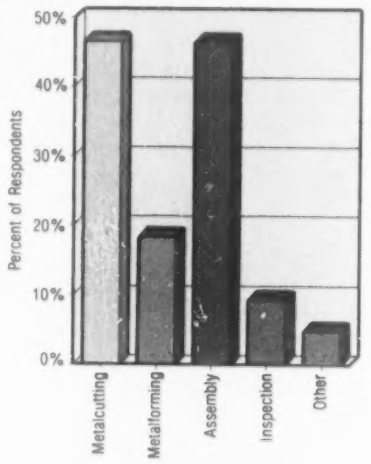
Why spend? As always, the desire to reduce direct labor is the leading reason (66.6 percent as compared with scrap rework, 24.3 percentage points lower at 42.3 percent) to purchase capital equipment. As discussed below, assembly operations—which apparently have a higher manual content than metalcutting and forming—appear to be the target here. But in recent years three trends have emerged as motives increasing for capital spending: (1) the pressure to improve quality, (2) push for reduced in-process inventory and (3) the need to eliminate scrap and rework.

Nearly half ($5.1 billion) of the total dollars to purchase equipment will go toward machine tools. About $3.8 billion worth of metalcutting machines will be sold next year. Of that, one-third ($1.2 billion) will go to purchase machining centers and one-quarter ($912 million) will be turning equipment. The next largest category of total equipment spending falls into the assembly area ($1.7 billion).

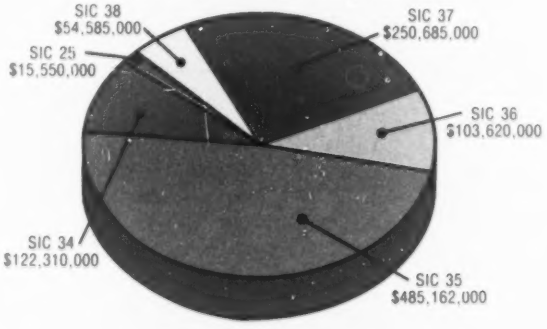
According to respondents, 73 percent of all equipment purchased will be sourced by a domestic supplier, an increase of 1 percent from the year earlier. When a company is planning to purchase equipment from an offshore supplier (and the number, 18 percent, is even with 1989) the rea-

CELLS

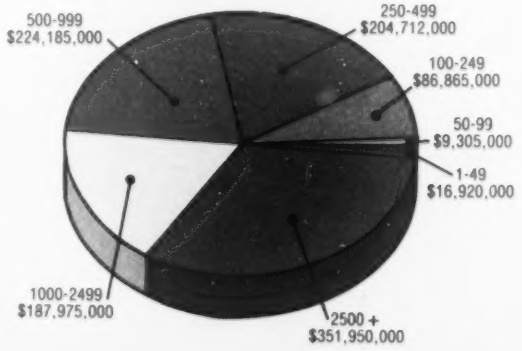
If you plan to purchase cells, the cell's primary function will be...?



Dollar Volume By 2-Digit SIC

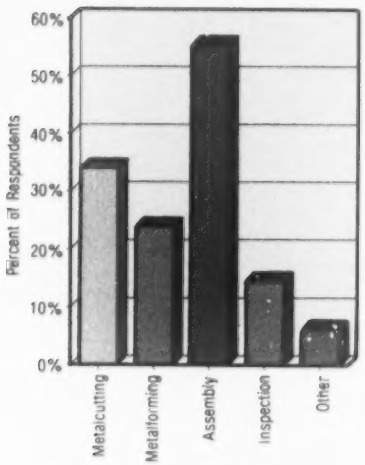


Dollar Volume By Plant Size

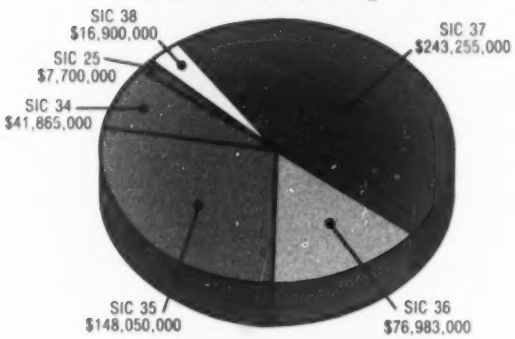


FMS

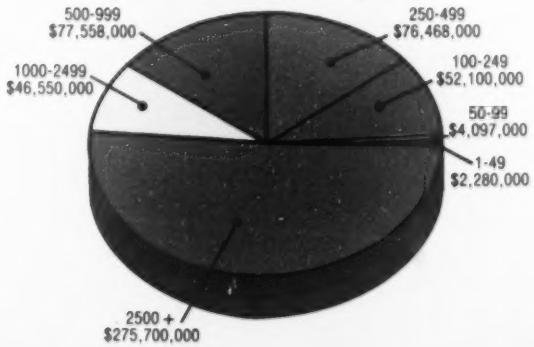
If you plan to purchase an FMS, the system's primary function will be...?



Dollar Volume By 2-Digit SIC



Dollar Volume By Plant Size



sons, in order of importance, are: equipment quality, features and then price.

FMSs vs. cells*. Of particular interest are the buying plans related to the more advanced manufacturing concepts of cells and flexible manufacturing systems (FMSs). Respondents told us that over the next two years they will spend twice as much on cells as systems: $1,081,000,000 vs. $534,750,000. (When does a cell become a system? Ask 10 people, get 10 definitions. See the footnote for ours).

Assembly is cited as the primary function of 46 percent of cells to be purchased and 55 percent of FMS purchases. If, as we think, there's a lot of handwork remaining in the nation's assembly operations, clearly manufacturers are going after direct labor through flexible automation. Interestingly, adding the numbers for FMS metalcutting (33.9 percent) and metalforming (23.8 percent) gives a sum just 2.5 percent above the number of planned assembly FMSs.

Cells will enjoy significant penetration into all but the very smallest plants. FMSs, on the other hand, will remain large plant oriented with more than half of the systems going into plants with more than 2,500 employees. However, both cells and systems will find most use in plants employing 500 or more.

If you would like to receive a copy of the results of PRODUCTION's 1990 Capital Spending Survey, please circle 250 on the reader service card.

**A manufacturing cell is defined as one materials handling device servicing multiple machines which are coordinated and paced by a computer or programmable controller.*

A flexible manufacturing system (FMS) is defined as multiple materials handling devices servicing multiple machines with a computer responsible for coordinating, pacing and scheduling.

SEPTEMBER 1990

PRODUCTION

C4080-1

THE MAGAZINE OF MANUFACTURING MANAGEMENT

Kennametal's **Hunt**

Heald's **Seymour**

Minster's **Winch**

DEA's **Curcuru**

Bosch's **Schaefer**

LeBlond's **Bowers**

G&L's **Fife**

Okuma's **Hendrick**

NMTBA's **Moore**

IMTS90

LOOKING AT TECHNOLOGY

LONG
J LONG-ASST MGING EDITOR
C H S/S RICACQUISITIONS
4320 EWR HIGHWAY
HYATTSVILLE MD
20814
C-P

PRODUCTION
SEPTEMBER 1990 THE MAGAZINE OF MANUFACTURING MANAGEMENT VOL. 102 NO. 9

34

IMTS90®
The world of manufacturing technology

42

FEATURES

34 Hiatus Europe: Americans Seen in Screw Machine Shops
Why they came, where they went, what they saw, and such like—plus, how a French screw machine manufacturer is trying to change the way Europe—and the rest of us—thinks.

40 The Uncomfortable Global Perspective
Everyone knows that it's a Darwinian struggle out there, survival of the fittest and all that. And comments about cooperation can be disconcerting. Richard Dove is making them, nevertheless.

IMTS-90

42 Welcome to the Future, Welcome to IMTS-90
—Comments from NMTBA President Al Moore

46 List of Exhibitors

62 Flexible Manufacturing Systems and Cells
—Comments from Bill Fife, Giddings & Lewis

68 Milling and Machining Centers (Including Boring and Drilling)
—Comments from Don Bowers, LeBlond Makino

90 Turning
—Comments from John Hendrick, Okuma America

100 Controls, Computers and Software
—Comments from Frank Schaefer, Robert Bosch Corp.

110 Grinding and Finishing
—Comments from Kyle Seymour, Cincinnati Milacron, Heald Machine Co.

125 Forming and Forging
—Comments from Harold Winch, Minster Machine Co.

134 Tooling and Fixturing
—Comments from Jim Hunt, Kennametal Inc.

150 Quality Control
—Comments from Ron Curcuru, DEA Inc.

160 Other Products and Equipment

DEPARTMENTS

4 Staff

9 Perspective
—Global Warming—and IMTS-90

10 Update
—Modular Tooling Goes Universal
—Serious Fun With Science

28 Applications and Developments
—Checking Quality at Maytag

30 Management Side
—How To Deal With a Shouter

171 Advertisers' Index

171 District Offices

172 Back of the Book
—Is This Page the Center of the Universe?

STAFF

EDITORIAL OFFICES

DETROIT

1100 North Woodward Avenue, Suite 120
Birmingham, MI 48009
313-647-8400
FAX 313-645-0749

Robert F. Huber
Editor-In-Chief

Gary S. Vasilash
Editor

Charlton Burch
Design Consultant

CINCINNATI

6600 Clough Pike
Cincinnati, OH 45244-4090
513-231-8020
FAX 513-231-2818
TELEX 214132

Brenda J. Fahringer
Managing Editor

Robin P. Bergstrom
Editor-At-Large

Jann S. Dunn
Assistant Editor

William A. Johnston, CBC
Art Director

Aimee M. Reilly
Assistant Art Director

Susan M. Payne
Artist

ABP Association of Business Publishers

BPA

BUSINESS OFFICE

6600 Clough Pike
Cincinnati, OH 45244-4090
513-231-8020
FAX 513-231-2818
TELEX 214132

Steven R. Kline, CBC
Publisher/Vice President

Daniel C. Luciano, CBC
Associate Publisher/Sales Manager

Donald E. Kline
Advertising Manager

Joyce M. Trestel
Advertising Production Manager

Charles Norman
Circulation Director

Philip A. Louis
Director of Data Processing

George E. Hay
Chairman

Richard G. Kline, CBC
President

Jo Ann C. Dooley
Vice President/Finance

Maralah S. Rose-Asch, CBC
Marketing Services Manager

EDITORIAL ADVISORY BOARD

Richard E. Dauch
Executive Vice President/Manufacturing
Chrysler Motors

Thomas Gunn
Vice President, Procurement and Distribution,
Product and Technology Operations,
Unisys Corporation

James L. Koontz
President & Chief Executive Officer
Kingsbury Machine Tool Corp.

Berthold Leibinger
President & Partner
Trumpf GmbH & Co.

Robert P. Collins
President & Chief Executive Officer
GE Fanuc Automation
North America, Inc.

George R. Ryder
Managing Director
PNA Services, Inc.
A Company of the Pininfarina Group

David C. Scott
Manager, Marketing
Deere Tech Services, Deere & Company

PRODUCTION (ISSN 0032-9819), founded in 1934, is published monthly by Gardner Publications, Inc., 6600 Clough Pike, Cincinnati, OH 45244-4090, telephone 513-231-8020, TELEX 214132, FAX 513-231-2818, and is sent on a complimentary basis to selected engineering and management personnel in production metalworking plants, and selected supplier industries. Complimentary subscription requests should be addressed to PRODUCTION Magazine, 6600 Clough Pike, Cincinnati, OH 45244-4090, and the following information must be supplied: Your name, title, company name and address (including zip code), product(s) produced and approximate number of employees in your plant. Requests must be received on company letterhead or on the business reply card provided in the magazine. All other subscriptions are $36.00 per year in North America, $72.00 elsewhere; airmail to foreign countries $144.00 per year. Printed in U.S.A. Copyright © 1990 by Gardner Publications, Inc. Second class postage paid at Cincinnati, Ohio. POSTMASTER: Send address changes to PRODUCTION Magazine, 6600 Clough Pike, Cincinnati, OH 45244-4090. If undeliverable, send Form 3579. PERMISSIONS: Libraries and other organizations registered with the Copyright Clearance Center (CCC, 21 Congress St., Salem, MA 02148-9998) may photocopy any article herein for the flat fee of $2.00 per copy of the article. Copying done for other than personal or internal reference use without the express permission of Gardner Publications, Inc. is prohibited. Address requests for special permission or bulk orders to the magazine. ISSN 0032-9819 $2.00.

The information presented in this edition of PRODUCTION Magazine is believed to be accurate. In applying recommendations, however, you should exercise care and normal precautions to prevent personal injury and damage to facilities or products. In no case can the authors or the publisher accept responsibility for personal injury or damages which may occur in working with methods and/or materials described herein, nor can the publisher assume responsibility for the validity of claims or performances of items appearing in editorial presentations or advertisements in this publication. Names, addresses, and/or telephone numbers are given to enable interested parties to conduct further inquiry into specific products or services.

UPDATE

'Have a Good Day'

Remember biorhythms? There is a company in England—The London Biorhythm Company—that has developed a handbag-size mathematical device that can establish the peaks and valleys in a person's bio's, which are widely believed to affect performance both positively and adversely. And, apparently with this knowledge, a degree of control over the likelihood of accidents can be gained.

The Bio-Display Unit is designed to give an accurate picture of a person's emotional, physical and intellectual well-being. Observations over many years show that these follow regular cycles of 23, 28 and 33 days respectively. The peaks and valleys of biorhythms are presented as three sine curves marking the relevant days and weeks. The central line about which they oscillate is termed the 'caution' or 'critical' line. It is when each cycle crosses this line—from negative to positive or vice versa—that physical, emotional or intellectual mistakes are most likely to happen.

Japan takes biorhythms seriously. Research conducted by the police force in Tokyo demonstrated that 82 percent of motor accidents occurred on critical biorhythm days, as did 82 percent of run traffic light offenses. More than 5,000 companies in Japan use biorhythm predictions to limit accident rates in factories.

Further research indicates the unexpected effect that a combination of three high points in a person's bio curves does not necessarily result in peak performance: Such a conjuncture can lead to overconfidence and carelessness. The best combination for most activities appears to be a combination of two high points with one low one.

*For more information on the Bio-Display Unit, circle **284** on the reader service card.*

Middle Market Merging: It's a Deal

"When selling a privately-held mid-size business, we counsel the business owner to remember that there are three parties to every transaction—the seller, the buyer, and the Internal Revenue Service."

That from David R. Hoods, division president of The Geneva Companies, Irvine, CA-based specialists in middle market mergers and acquisitions.

More than ever, deal structure creativity is the single most important element in successfully closing these transactions, and Hoods says preservation of after-tax wealth is a key element. "It's not uncommon to see money loaned to the seller's business using the seller's stock as collateral included in the deal structure of a 1990 middle market merger and acquisition. Middle market business sellers are also being encouraged to participate in the future of the business as consultants or part-time managers as another deal structuring technique."

Hoods says that the deal structuring strategy is welcomed by both seller and buyer in that the seller is able to defer a portion of the taxes on the sale and it helps the seller make a leisurely transition from running the business full-time. The buyer benefits by deferring a portion of the purchase price, and having the seller as continuity helps reduce the buyer's learning time.

Unlike the huge hostile takeovers that make the headlines, these middle market deals, says Hoods, typically have a seller who is now ready to sell. "When asked why they are considering the sale of their business, the most frequently given reason by the typical seller continues to be boredom or burnout." Not to mention that large U.S. and foreign corporations are scouting for strategic acquisitions of middle market businesses to enhance their own businesses. It's a favorable selling climate.

R&D: Short-term Survival, Long-term Jeopardy

The top 100 spenders on research and development among U.S. corporations did not increase their R&D funding as much in 1989 as in 1988. The recently issued annual survey by Inside R&D®, the weekly intelligence service for corporate executives, reveals that R&D spending for the 100 increased 8.7 percent in 1989, compared with a gain of 10.7 percent in 1988.

Still, the research-minded top 100 did considerably better than U.S. companies in general which the National Science Foundation says boosted spending only four percent. Charles Joslin, Inside R&D® editor, says the slowdown, which had been seen in other companies since the mid-1980s, is now seeping up into the top 100.

Joslin blames a new emphasis by the big spenders on pursuing incremental product improvements, in imitation of the Japanese, instead of pushing more basic research toward big breakthroughs. Companies are less likely to fund speculative research that might lead them outside present product lines. This strategy and other research economies are pursued by managers anxious to hold down costs. Goals are short term: Keep company stock out of reach of corporate raiders.

For more information, contact Charles Joslin, Inside R&D®, P.O. Box 1304, Fort Lee, NJ 07024-9967; telephone 201-568-4744; FAX 201-568-8247.

Industry (number of companies included)	1989	1988	% Increase
Computers (15)	11,510.4	9,840.5	17.0
Motor vehicles (4)	9,491.8	8,664.5	9.5
Pharmaceuticals (13)	5,688.4	5,068.6	12.3
Electronics (15)	5,280.0	4,779.7	10.5
Aerospace (10)	4,729.4	4,656.5	1.6
Chemicals (9)	4,127.7	3,849.7	7.2
Scientific and photographic equipment (6)	3,917.6	3,264.8	20.0
Telecommunications (2)	2,933.0	2,869.0	2.2
Petroleum (8)	2,055.0	1,918.0	7.1
Industrial and farm equipment (4)	694.0	597.9	16.1

Source: Inside R&D®